Monitoring Linux performance with Orca

WATCHING THE WATERS

Monitor and troubleshoot Linux system performance with the free and powerful Orca. **BY KENNETH HESS**

Enter the mysterious, and much neglected, world of performance monitoring. The mystery and neglect have the same root cause; performance analysis is a very complex issue that can be quite daunting. Performance engineers typically deliver thick reports replete with statistical equations, graphics, and polysyllabic run-on sentences to explain why you will need to replace your current infrastructure within a given time frame. System administrators yawn at the lengthy explanations and statistics equations that, frankly, can look like recipes written in Martian. You may be wondering why you really need to worry about performance monitoring for Linux since hardware is at almost “throw-away” prices today. The answer is that, for larger installations of Linux and mission-critical applications, it is less expensive to add to your infrastructure than to replace it. With clustering, fail-over applications, and distributed environments supporting hundreds or thousands of users, adding another 4 CPU server with 4GB of RAM is infinitely more palatable to those who write the checks than replacing everything you have because you have run out of resources. By collecting performance data, you can make informed decisions about upgrading, adding to, or replacing hardware as business growth dictates.

Introducing Orca

The mystery, neglect, and boredom often evoked by performance analysis can be made far less severe with a tool called Orca. Orca gives you system performance reports in a graphical format in HTML pages. By default Orca presents graphical plots of several important performance parameters (see the box labeled “Orca Default Parameters”).

Orca is quick and easy to set up – about 30 minutes, which includes reading the *INSTALL* file. The powerful Orca is generously provided for free by Dr. Blair Zajac. You’ll find the Orca website

Gil Ronduen

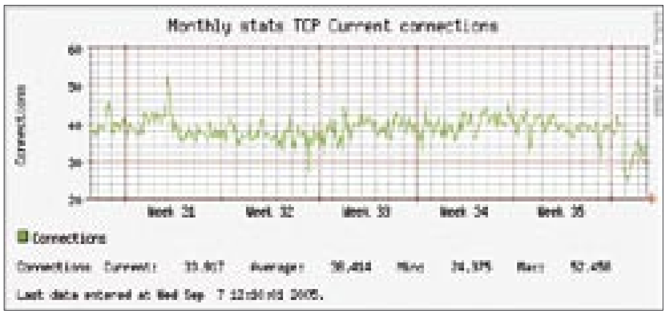


Figure 1: Ocra provides a clear graphic image of the plot, showing the X and Y coordinate axes as well as the current, average, minimum, and maximum values.

at: *http://www.orcaware.com*. Blair describes Orca as “a tool useful for plotting arbitrary data from text files onto a directory on a Web server.” Orca reads white space separated data files and watches the files for updates, creating plots of the data in the files. Orca can also plot the results of arbitrary Perl expressions, including mathematical expressions.

Orca then assembles the plots into an HTML tree of HTML or PNG formated graphs, creating an index of URL links listing all available targets. Orca can run under cron, or it can sleep by itself waiting for file updates.

Charting Performance

A default installation gives you hourly, daily, weekly, monthly, quarterly, and yearly summary data represented graphically and in tabular form. Its graphics provide you with summary information that is complete, yet visually simple enough to do a quick scan of many servers in a short amount of time. For each parameter that is measured, you get a graphic image containing the X and Y coordinates properly labeled with your data in tabular format showing current, average, minimum, and maximum values for the specified time (See Figure 1).

Orca utilizes RRDTool, a tool written by Tobias Oetiker, for logging and graphing. Orca is bundled with RRDTool and other required Perl modules in case you don’t have them installed already. The requirements that need to be met prior to installation are very few. You need a working web server and Perl. During installation, the missing Perl modules will be installed for you into an Orca specific library directory so that it doesn’t conflict with any existing package management systems (see the box titled “Orca and Perl”). The source trees for all the components are under the packages directory in case you would like to install them manually. The Procallator “package” is also installed with Orca. Procallator is the Linux-specific script that runs periodically to gather data from the */proc filesystem* on Linux.

Installation

Let’s assume you have Perl and a web server already installed and working on your system. Dr. Zajac suggests you download the latest snapshot release [3]. Download, un-bzip2, and untar the file, then cd into the source directory that was created. I suggest that you read the *INSTALL* file before continuing with your actual installation, in case you need some special parameters for the configure script. At a minimum, you will need to know where you want your HTML files to go prior to using Orca. I chose my default web directory */var/www*. Go ahead and create */var/www/procallator* or Orca will complain that the directory does not exist when you run it for the first time. The html files and graphics will be created in this directory. Once you are prepared for the installation, issue the following commands:

```
./configure -with-html-dir=➥
/var/www
make
make check (optional)
make install
```

There’s already a Makefile target named *procallator_run_at_boot_using_chkconfig* to start Procallator at boot time on RedHat, CentOS, and chkconfig-based systems. Dr. Zajac is adding different makefile targets to start Procallator at boot time for Debian and Ubuntu systems. He is also working on startup scripts for Orca.

That is all there is to the basic installation, which places the executables in */usr/local/bin* by default. At this point, you can issue the *procallator* command to begin data collection while you go into the configuration phase.

To begin collecting data, issue:

```
/etc/init.d/procallator start
```

Procallator will start in background mode and begin data collection using default locations and parameters.

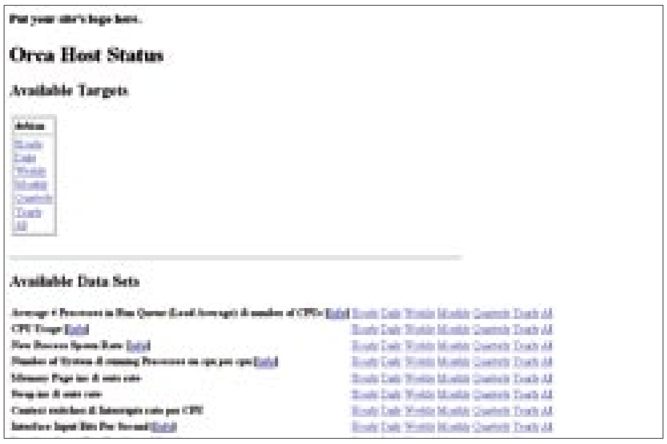
Orca Configuration

The *procallator.cfg* file is in */usr/local/etc*, assuming you used the default *configure -prefix* setting. *procallator.cfg* contains the file locations and variables that

Orca Default Parameters

By default, Orca monitors the following parameters:

- Average # Processes in Run Queue (Load Average) & number of CPUs
- CPU Usage
- New Process Spawn Rate
- Number of System & running Processes on CPU per CPU
- Memory Page ins & outs rate
- Swap ins & outs rate
- Context switches & Interrupts rate per CPU
- Interface Input Bits Per Second
- Interface Ouput Bits Per Second
- Interface Input Packets Per Second
- Interface Output Packets Per Second
- Interface Input Errors Per Second
- Interface Output Errors Per Second
- Interface Input Dropped Per Second
- Interface Output Dropped Per Second
- Interface Output Collisions
- Interface Output Carrier Losses
- IP Traffic statistics
- IP Error statistics
- TCP Connection statistics
- TCP Traffic statistics
- TCP Error statistics
- ICMP statistics
- UDP statistics
- Disk System Wide Reads/Writes Per Second
- Disk System Wide Transfer Rate
- Disk Reads/Writes Per Second
- Disk Transfer Rate
- Disk Space Percent Usage
- Physical Memory usage percent
- Swap usage percent.


Put your site's logo here.

Orca Host Status

Available Targets

debian
Hourly
Daily
Weekly
Monthly
Quarterly
Yearly
All

Available Data Sets

Average # Processes in Run Queue (Load Average) & number of CPUs [Info] Hourly Daily Weekly Monthly Quarterly Yearly All
CPU Usage [Info] Hourly Daily Weekly Monthly Quarterly Yearly All
New Process Spawn Rate [Info] Hourly Daily Weekly Monthly Quarterly Yearly All
Number of System & running Processes on cpu per cpu [Info] Hourly Daily Weekly Monthly Quarterly Yearly All
Memory Page ins & outs rate Hourly Daily Weekly Monthly Quarterly Yearly All
Swap ins & outs rate Hourly Daily Weekly Monthly Quarterly Yearly All
Context switches & Interrupts rate per CPU Hourly Daily Weekly Monthly Quarterly Yearly All
Interface Input Bits Per Second [Info] Hourly Daily Weekly Monthly Quarterly Yearly All

Figure 2: The Orca index.html page provides quick access to graphs.

you can change to meet your specific needs. You can (and should) change the following items to customize your site.

Change the email address to one that will be regularly monitored in case something goes wrong:

```
warn_email    root@localhost
```

If you want hourly plots, change the 0 to 1 and vice versa for any of the other time plots. I generally use the hourly plot for watching a system that may be in "trouble."

The following parameters specify which plots to generate:

```
generate_hourly_plot    0
generate_daily_plot     1
generate_weekly_plot    1
generate_monthly_plot   1
generate_quarterly_plot 1
generate_yearly_plot    1
```

The *find_files* parameter points to the base data directory for raw data. By default, this directory is */usr/local/var/orca/procallator*. Under this directory, you will find your raw data directory. It is named the same as the *hostname*. The raw data files are named as *procol-YYYY-MM-DD-00X*. Each night, the last opened raw data file will be compressed as either *procol-YYYY-MM-DD-00X.gz* or *procol-YYY-MM-DD-00X.bz2* to conserve disk space. If you want to modify the location of this directory, you will need to manually edit the */usr/local/bin/procallator* script and change the *$DEST_DIR* setting and also edit the *find_files* value in *procallator.cfg*.

Data Collection

Once you have edited the *procallator.cfg* file to your satisfaction, you are now ready to use Orca. If you started the data collector (Procallator) at the end of installation, you should now have enough data to plot. (By default, Procallator measures the system on five minute intervals, so you may have to wait for the first measurement to be taken.) To give Orca a try, enter the following command:

```
orca -o /usr/local/⮐
etc/procallator.cfg
```

This command tells Orca to run once (-o) and refers it to the configuration file that we just edited. This first pass will create necessary directories and files in your */var/www/procallator* directory. When Orca has finished processing the data, you will get the message "Orca has completed." You can now check out your performance data at:*http://yourserver/procallator/*.

There will probably not be much to look at in terms of actual data, but all of the default plots and pages are now created and ready for you to inspect. Your *index.html* page should look something like the page shown in Figure 2.

Notice that the title of the box is, or should be, your hostname. In the example case, the hostname is debian. If you click one of the links, you will be taken to the performance data pages for that timeline. The example graphic in Figure 3 shows the first of the hourly graphics for my host, debian.

The graphics are self-labeling and include the name of the host to which they refer. This will come in handy when you are looking at multiple hosts in a short amount of time. To see a real-life example of Orca on multiple hosts, point your browser to: *http://stats.xmission.com/linux/*.

You should set up Orca to run hourly if you want the hourly plots to be updated that often. My cron entry is:

```
@hourly /usr/local/bin/orca -o⮐
 /usr/local/lib/procallator.cfg
```

If you only want Orca to run daily (at midnight) use:

```
@daily /usr/local/bin/orca -o⮐
 /usr/local/lib/procallator.cfg
```

Of course, you may use any time interval you wish. These are just examples.

Troubleshooting

Installing, configuring, and using Orca and Procallator is very simple. There isn't much to troubleshoot for Orca for a default install. If, however, you need to customize something, sometimes there can be issues with the number of columns in the RRD files compared to those that Orca is using.

Column data is a very common issue and is covered in the Orca FAQ [4]. There are a couple of issues that are not covered in the FAQ with which you may need assistance. The first is gaps in your data. You may experience, at some point, gaps in your data. The second is that you need to completely regenerate your data for any number of reasons. Both of these issues have the same resolution; remove the RRD files and reprocess your data. Look in your *procallator.cfg* file to find the location of *rrd_dir*. The default location is: */usr/local/var/orca/rrd/procallator/*.

Under this directory is another directory called *procallator_hostname*, where the RRD files are kept. To regenerate the data, remove all of the RRD files. Then issue the following commands. These commands will regenerate the necessary RRD files without recreating the html and graphics:

Orca and Perl

Requirements for Orca on Linux

- Perl 5.005_03 or higher
- RRDtool's RRDs Perl module, preferably 1.0.50 with local patches, or 1.2.x
- Data::Dumper 2.101
- Date::Parse 2.24
- Devel::DProf 19990108
- Digest::MD5 2.33
- Math::IntervalSearch 1.05
- Storable 2.15

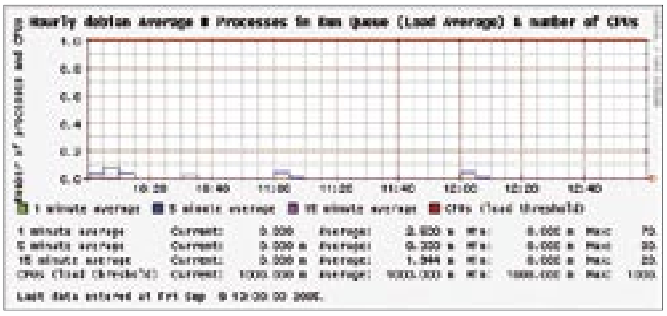


Figure 3: Example Orca graph showing statistics for a typical Linux host.

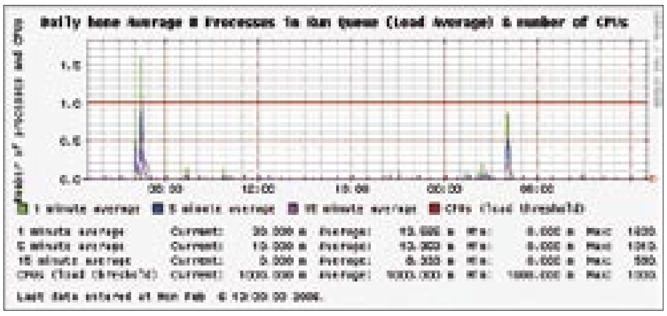


Figure 4: Periodic CPU performance spikes may be the result of a regularly scheduled process, such as a daily run of up2date.

```
/usr/local/bin/orca ➘
-o -no-html -no-images ➘
/usr/local/etc/procallator.cfg
```

Then process the RRD files normally, creating the html and graphics.

```
/usr/local/bin/orca -o ➘
/usr/local/etc/procallator.cfg
```

The reason for this two-step process is to spare system resources. If you process a great deal of data, creating the RRD files, html, and images may run your machine critically low on swap space. If there are gaps in your data and it was caused from the data collector being down, you will not be able to fill in the gaps.

Startup Scripts

By putting the data collector in your startup scripts, you will ensure that, even after a reboot, your data will not suffer wide gaps. There are some startup scripts provided for you in the source tree under the *data_gatherers* directory. It would also be wise to put in a process checker script to make sure the data collector does not go down and cause gaps in your data. If the process dies, have the script restart Procallator and email you an alert. If you choose to have Orca running continuously, that is, without the *-o* command line option, Orca will send out emails when it sees that a data file has not been updated in a few minutes.

Performance Monitoring

As a System administrator you should do regular performance checks on your systems. As stated earlier, Orca makes this easy. You can check a number of hosts at a glance then move on to other tasks. The parameters that I check regularly are CPU, Memory, Network, and Disk Usage. These are the most problematic areas for production systems. You first need to learn what a healthy system's graphics look like so that you can easily and readily recognize performance issues. When I check performance using Orca, I use the Weekly Performance Charts, noting any spikes or suspicious trends in performance. If I detect anything unusual, I then go to the daily charts. Figure 4 shows a system with CPU performance spikes. Since I am familiar with this system, I know these spikes are associated with my daily scheduled run of up2date.

I like to check the Daily graphs because they give me a very fine grained look at the last 24 hours worth of performance data. Hourly graphs will give you the finest grained look at your data, although I don't regularly check them unless the Daily graph gives me a reason to take a closer look.

In addition to these specific performance graphs, I check *sar*, *mpstat*, and *iostat* values to more clearly diagnose any problems detected in the Daily or Hourly Orca graphs. Quarterly and Yearly charts are very useful for visualizing performance trends. These graphs are most valuable for observing performance degradation over time, as well as for providing hard evidence that your network is in need of hardware additions, upgrades, or replacements. These charts are also extremely handy when printed out and taken into managerial meetings. One word of caution: make every effort to perform careful analyses and do some performance tuning before recommending upgrades or replacements.

Diligent performance monitoring means being vigilant and learning the quirks and personalities of all of the systems under your control. Orca is one way to maintain vigilance. My experience with Orca and Procallator comes from direct work with these tools in a very large enterprise environment where availability and performance directly affect the bottom line. For anyone who needs to check the performance of just a few systems, or up to hundreds, I strongly recommend Orca.

Conclusion

We have only had the opportunity to scratch the surface on the very broad topic of Linux performance monitoring. The subject would make an excellent topic for a book. (I hope my agent reads this.) Orca is an excellent tool for assessing current activity and watching trends in performance for your systems. In my opinion, it should be installed on your existing systems and all the new systems you acquire. The information it provides is invaluable to system administrators, architects, and management for making intelligent decisions in tuning, purchasing, and upgrading the computing infrastructure. ■

INFO

[1] Orcaware: *http://www.orcaware.com/*

[2] RRDTool: *http://people.ee.ethz.ch/~oetiker/webtools/rrdtool/*

[3] Orca Snapshots: *http://www.orcaware.com/orca/pub/snapshots/*

[4] Orca FAQ: *http://www.orcaware.com/orca/docs/FAQ.html*

THE AUTHOR

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